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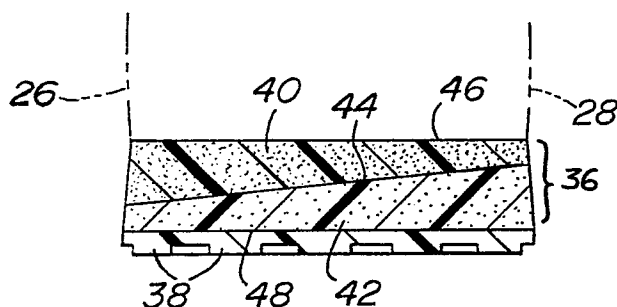
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⑤④ **Running shoes.**

⑤⑦ A pair of running shoes (20) each of which has a midsole (36) which, at least in the heel region, is made of two layers (40, 42) with complementary tapers across the width of the sole to provide a horizontal upper surface (46) when the lower surface (48) is horizontal. The two layers are of different durometers, the tapers and durometers being so selected that the ratio of the thickness of higher durometer to lower durometer material is greatest adjacent the inner or varus side (26) of the sole. This construction lessens abnormal pronation of the foot as the arch flattens during running and increases contact surface area, thus distributing impact shock more evenly.



RUNNING SHOES

This invention relates to running shoes.

Various athletic shoes particularly suited for running are commercially available. Such shoes commonly include an upper and what can be called a

5. "neutral plane" sole, that is a sole which is of uniform thickness between the inner (varus) side of the shoe and the outer (valgus) side of the shoe. Such soles, although usually comprising an outsole and a midsole, are commonly formed of uniform density between the varus
10. and valgus sides. The human anatomy is such that when a person runs, or walks for that matter, the rear valgus portion of the heel of each foot makes initial contact during each step. The ground contacting foot then rolls inward, a process called pronation, whereupon the
15. person's body weight is brought from the outside edge of the foot inward toward the centre of the arch. The foot then rolls outwardly and toes off toward the great toe to complete a step.

- It is widely recognized that the vast majority of
20. runners exhibit improper pronation when running in prior art shoes like those described above. Many people initially land on the outside of the heel of the ground contacting foot, with the foot rolling inward with improper biomechanical action and remaining rolled
 25. inward. Such improper action is referred to as overpronation. In addition, it has been shown that when running, three to four times the gravitational force is applied to the outside edge of the foot, and in particular to the heel area, than occurs when walking. The
 30. high force concentrated at the heel area, coupled with

the tendency of most runners to roll their feet inward forcefully during running results in increased shock to the foot and increased heel wear of the shoe being worn.

5. In US-A-4,180,924 there is described a running shoe featuring a sole having a wedged portion canted upward in a transverse direction from the outer side of the shoe to the inner side of the shoe so that during running a substantial portion of the sole makes
10. contact with the ground during each step. Although this type of construction remedies many of the drawbacks associated with a conventionally designed running shoe, the physical canting of the sole may not be desired by some runners, e.g., slow runners.
15. In US-A-4,364,188 there is described a running shoe having a neutral plane sole including portions at the heel on the varus side which are of higher density (durometer) than the remaining portion of the sole in the interest of "rearfoot stability".
20. It is a general object of the invention to provide running shoes which overcome the disadvantages inherent in the prior art running shoes and, in particular, to provide a pair of neutral plane running shoes, each of which has means for lessening the abnormal pronation of
25. the foot as the arch flattens during running.
- These objects are attained by the present invention according to which each of a pair of running shoes comprising an upper and a sole running the length of the shoe from the heel to the toe, the sole comprising
30. an outsole and a midsole, is characterised in that the midsole includes a first member and a second member, each member varying in thickness across the width

- thereof, said first member being disposed about said second member so that the combined thickness of said members is constant across the width of said sole, the said members being formed of materials having
5. different durometers from one another so that the ratio of the thickness of the higher durometer material relative to the thickness of the lower durometer material is greatest immediately adjacent the inner side of the sole and is lowest immediately adjacent
10. the outer side of the sole.

- The construction of the sole according to the invention lessens abnormal pronation. In addition, the shoes may be constructed so that impact shock is distributed evenly during running; at the same time
15. the shoes employ a transversely level or "neutral plane" sole. Moreover, the construction of sole permits greater contact surface area than conventional shoes, thereby distributing impact shock more evenly during running, yet providing medial longitudinal arch
20. support for decreasing abnormal pronation, while allowing for the natural pronation of the foot.

- The invention may be carried into practice in various ways but two pairs of running shoes embodying the invention will now be described by way of example
25. with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the right shoe of the first pair of running shoes;

Figure 2 is an enlarged sectional view taken along line 2-2 of Figure 1; and

30. Figure 3 is an enlarged sectional view of the right shoe of the second pair of running shoes taken along a line located at a position corresponding to the line 3-3 of Figure 1.

Figure 1 shows a running shoe 20 designed to be used by the competitive runner or recreational jogger alike. The shoe basically comprises a conventional upper 22 and a sole unit 24. The upper 22 has an inner 5. or varus side 26 and an outer or valgus side 28. The sole unit 24 runs the entire length of the shoe from the heel 30 to the toe 32 between the varus and valgus sides 26 and 28, respectively.

In referring to Figure 2 it can be seen that the 10. sole unit 24 comprises an outsole 34 and a midsole 36. The outsole is of conventional construction and includes plural gripping elements or cleats 38.

The midsole is formed as a composite structure and, as will be described in detail hereinafter, is 15. arranged to provide the over-pronation lessening characteristics exhibited by running shoes constructed in accordance with US-A-4,180,924 in a neutral plane sole. To that end the midsole 36 includes two layers, namely top layer 40 and bottom layer 42. The layers 20. extend for a substantial length of the sole between the heel and to a point adjacent the front of the arch. Each layer is formed of a resilient material like that used in midsoles of conventional running shoes, except that the hardness or durometer of each layer is different 25. from that of the other.

In the embodiment of the midsole shown in Figure 2 the upper layer is of higher durometer material than the lower layer. For example, depending upon the type of shoe, the upper layer can have a durometer within 30. the range of 45+ 10%, Shore A, while the lower layer

has a durometer within the range of 35+ 10%, Shore A. The layers of the midsole 36 are preferably made of ethyl vinyl acetate (EVA) but, alternatively, may be made of polyurethane or any number of other

5. materials used in running shoes.

The thickness of each layer varies across the width of the sole, i.e., between the varus and valgus sides, but with the combined thickness of both layers being constant across said width. This feature

10. ensures that the sole is of the "neutral plane" type.

The layers 40 and 42 are constructed so that the layer having the thicker portion contiguous with the varus side is of the higher durometer material. Accordingly, the hardness of the midsole contiguous

15. with the varus side of the sole is higher than that of the valgus side. With such a construction, during the pronation phase of each running step the varus side of the shoe does not compress as readily as the valgus side. Therefore, the abnormal tendency toward over
20. pronation is obviated or at least minimized.

In the embodiment of Figures 1 and 2, the top layer 40, which is formed of higher density material tapers linearly in thickness from the varus side to the valgus side, with the ratio of the higher density

25. material to the lower density material being approximately 3 to 1 adjacent the varus side and approximately 1 to 3 adjacent the valgus side. Conversely the lower layer 42, which is formed of the lower density material, tapers linearly in thickness from the valgus
30. side to the varus side. The degree of taper of both

layers is the same. The layers are adhesively secured along their interface 44. The top surface 46 of the top layer 40 and the bottom surface 48 of the bottom layer are disposed horizontally so that the

5. combined overall thickness of two layers of the midsole 36 in a transverse direction across the width of the sole is constant.

As is conventional, the midsole 36 is thicker under the heel of the upper and tapers downward longitudinally under the arch toward the forefoot area, to provide the necessary heel lift or elevation for comfortable, safe running. The total thickness of the midsole 36 is between 15 mm and 25 mm at its thickest portion, with the exact thickness depending on several

10. factors, such as the type of running intended (e.g., racing, recreational jogging, etc.) and the personal preference of the wearer. From Figure 1, it will be seen that at least on the varus side, the bottom layer 42 of lower durometer tapers longitudinally to a

15. thickness of zero adjacent the arch of the wearer's foot and from there forward the midsole consists only of the upper layer 40 of higher durometer. In an alternative construction, however, the bottom and top layers both extend the full length of the sole but in

20. the region forward of the wearer's arch they are both of constant thickness across the width of the sole. Thus, in either construction, the ratio of the thickness of the lower durometer material to the higher durometer material varies from the outer side

25. of the shoe to the inner side of the shoe over the

30.

portion of the sole region extending the full length of the heel to a point adjacent the arch of the wearer's foot, said ratio being constant over the remaining portion of the sole.

5. It will be understood that the left shoe of the pair is of corresponding construction but appropriately 'handed' so that the higher density material is again thicker at the varus side and the lower density material is thicker at the valgus side.
10. In the second pair of shoes embodying the invention, the general construction is the same as that described with reference to Figures 1 and 2 but, as is shown in Figure 3, the higher density and lower density materials, forming the two layers of the
15. midsole, are transposed. Accordingly in this embodiment the top layer 40 is formed of the lower density material and tapers from the valgus side to the varus side, while the bottom layer 42 is formed of the higher density material and tapers from the varus side to the
20. valgus side.

It must be pointed out at this juncture that the two layers 40 and 42 need not taper linearly across the width of the sole, as shown in Figures 2 and 3, nor need they be of corresponding thicknesses tapering in
25. opposite directions, so long as the ratio of the thickness of the higher durometer material relative to the lower durometer material is greatest adjacent the varus side, e.g., the layer of higher density has its thicker side at the varus side of the sole, and
30. the top surface of the top layer is substantially

horizontal in the transverse direction when the outsole is flat on a horizontal running surface. Moreover, the two layers need not be formed as separate units which are secured together.

CLAIMS

1. A pair of running shoes (20), each of said shoes comprising an upper (22) and a sole (24) running the length of the shoe from the heel (30) to the toe (32), the sole comprising an outsole (34) and a midsole (36), characterised in that the midsole includes a first member (40) and a second member (42), each member varying in thickness across the width thereof, said first member being disposed about said second member so that the combined thickness of said members is constant across the width of said sole, the said members being formed of materials having different durometers from one another, so that the ratio of the thickness of the higher durometer material relative to the thickness of the lower durometer material is greatest immediately adjacent the inner side (26) of the sole and is lowest immediately adjacent the outer side (28) of the sole.

2. A pair of running shoes as claimed in Claim 1 in which the ratio of the thickness of the lower durometer material to the higher durometer material varies from the outer side (28) of the shoe to the inner side (26) of the shoe over the portion of the sole region extending the full length of the heel to a point adjacent the arch of the wearer's foot, said ratio being constant over the remaining portion of the sole.

3. A pair of running shoes as claimed in Claim 1 or Claim 2 in which the ratio of relative thicknesses of the two materials varies linearly across the width of the sole.

4. A pair of running shoes as claimed in Claim 1 or Claim 2 or Claim 3 in which the midsole is constructed such that the higher durometer material is on top of the lower durometer material.

5. A pair of running shoes as claimed in Claim 1 or Claim 2 or Claim 3 in which the midsole is constructed so that the lower durometer material is on top of the higher durometer material.

6. A pair of running shoes as claimed in any of Claims 1 to 5 in which said higher durometer material is $45 \pm 10\%$, Shore A, and said lower durometer material is $35 \pm 10\%$, Shore A, durometer.

7. A pair of running shoes as claimed in any of Claims 1 to 6 in which the thickness of the midsole is greater in the heel portion than in the toe portion.

FIG. 1

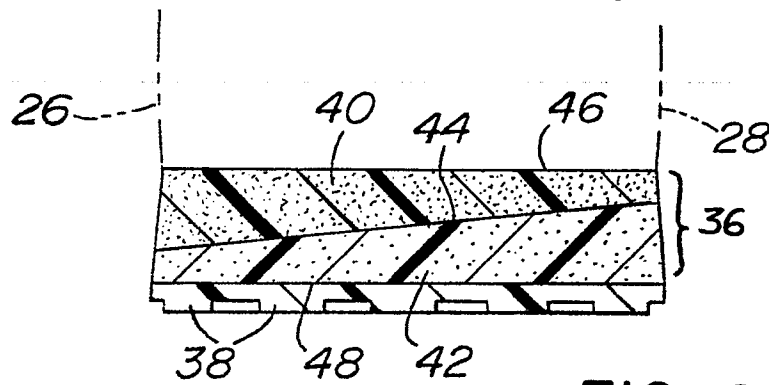
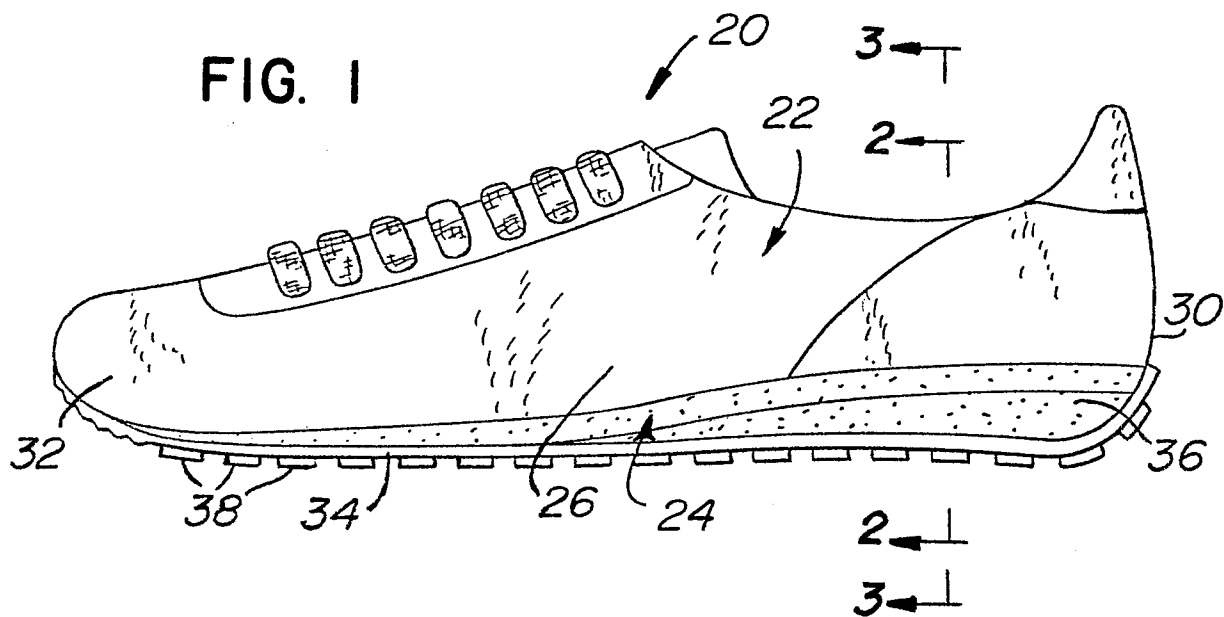
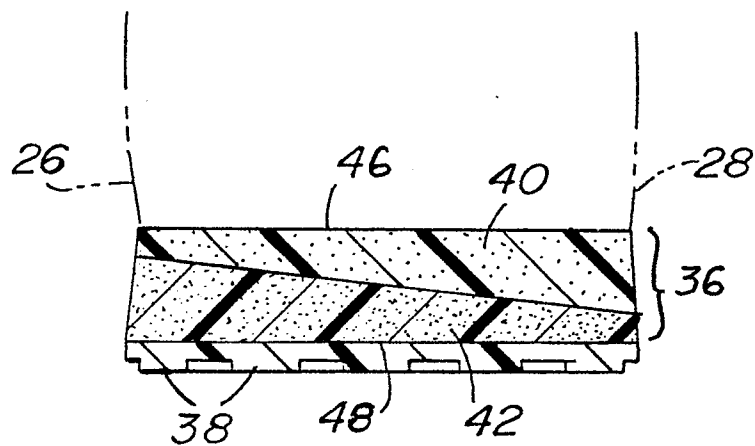


FIG. 2

FIG. 3





European Patent
Office

EUROPEAN SEARCH REPORT

0092366

Application number

EP 83 30 2053

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	US-A-4 316 334 (H.M. HUNT) * Column 4, lines 14-16; figure 1b *	1-7	A 43 B 13/12 A 43 B 13/14
Y	--- US-A-3 738 373 (J.J. GLANCY) * Column 2, lines 44-67; figures 1-6 *	1-7	
Y	--- CA-A- 920 352 (T.P. WHITE) * Page 8, lines 11-16; figure 3 *	1-7	
P	--- US-A-4 364 189 (B.T. BATES) * Column 6, lines 17-26; figure 4 *	1-7	

			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			A 43 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-07-1983	Examiner MALIC K.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	